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Merit-Aid and the Distribution of Entering Students Across Ontario Universities*

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Abstract

Tuition levels at Ontario universities have risen along with the value of merit-based entry scholarships provided by the nineteen institutions in this relatively closed system. We use data on entering students from 1994 through 2005 and find that merit awards have at most a small effect on a university's share of academically strong registrants. Such aid, however, is strongly associated with an increase in the ratio of students from low-income neighborhoods to students from high-income neighborhoods. Finally, although more advantaged students are more likely to attend university, merit aid is not strongly skewed towards the more advantaged conditional upon registration.

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1. Introduction

Since the early 1990's, more than a dozen states in the U.S. have established broad-based merit aid programs that waive or greatly reduce tuition and fees at public colleges and universities in the home state. The purposes of these scholarships have been to facilitate participation in post-secondary education and encourage high ability students to stay in state. Over the same period, a growing number of universities in Ontario made the unilateral (not provincially mandated) decision to institute programs of guaranteed merit scholarships for incoming, and in some cases, continuing students. Virtually all Ontario universities are publicly funded and the system is quite self-contained. Ninety-five percent of university students from Ontario are enrolled at Ontario universities and 95% of Canadian students (and 90% of all students) enrolled at Ontario universities are from Ontario (Statistics Canada 2008). The main purpose of the scholarships in Ontario is neither to promote post-secondary educational participation nor to keep high ability students in the province but rather to attract academically strong students to the individual institution. Throughout 1994-2005, which is the period covered in this paper, Ontario had 19 such institutions. In 1994 only two of these universities had guaranteed entry scholarships for students with a high school grade point average (GPA) of 80 or more and another eight universities had guaranteed entry scholarships for students with a GPA of 90 or more. By 2005, thirteen (sixteen) universities had guaranteed entry scholarships for students with a GPA of 80 (90) or more,

The questions that we consider in this paper are related, but not identical to, the questions that have been addressed in the U.S. literature. The first question we consider is whether or not these scholarships had an impact on the distribution of high performing Ontario

high school students across the 19 universities in this relatively closed system. In other words, does merit aid attract a greater share of strong students to an institution? The appeal of these scholarships may be different for students from different socioeconomic backgrounds. Hence, we ask a second question. Does the answer to the first question, the impact of these scholarships on the proportion of high performing students enrolled at a university, vary among students from low-income, middle-income and high-income neighbourhoods? Students from different socioeconomic backgrounds may also vary in the ability to qualify for merit aid. Hence, we ask a third question. Are the students from more privileged backgrounds disproportionately likely to benefit from this form of aid? More specifically, how are the benefits of this merit aid distributed across students from low-income, middle-income and high-income neighbourhoods?

The next section provides a review of the literature. A description of the Ontario university system and our data are presented in Section 3. Our regression results are presented and discussed in Section 4. A summary and conclusion are in Section 5.

2. Literature Review

Three recent Canadian studies have examined the determinants of choices concerning university applications and enrolment though none of these considers merit-based aid. Two of these studies used the university level data provided by the annual "universities" issue of Maclean's magazine. These rankings, which are similar to those provided by U.S. News for American colleges and universities are provided within three categories: Medical/Doctoral, Comprehensive and Primarily Undergraduate. Mueller and Rockerbie (2005) report that the

annual rankings in Maclean's magazine have a significant impact on both total applications and high school grade averages among first year students at Ontario universities for the period 1994 through 2000. This effect was strongest for Medical/Doctoral universities and weakest for Primarily Undergraduate universities. Kong and Veall (2005) use similar measures for all Canadian universities over the period 1991 through 2004. They find that an increase in the Maclean's ranking is associated only weakly with an increase in high school grade averages among entering students at Medical/Doctoral universities and is not associated with increased enrolments at any category of university. Drewes and Michael (2004) use individual application data from the Ontario Universities Application Centre (OUAC) for Ontario students applying for admission in the 2001-2002 academic year. A low Maclean's ranking reduces applications from academically stronger students to Primarily Undergraduate universities but not at other institutions. They also report that applicants prefer universities that spend a larger proportion of their operating budget on scholarships and non-academic student services.

A second strand of Canadian literature examines the relationship between family income and participation in postsecondary education (Bouchard and Zhao 2000, Christofides, Cirello and Hoy 2001, Corak, Lipps and Zhao 2003, Bowlby and McMullen 2002, Tomkowicz and Bushnik 2003, and Barr-Telford et al. 2003). Data from the Survey of Consumer Finances, the Survey of Labour and Income Dynamics and the General Social Survey have all indicated that rising levels of tuition and debt have not resulted in marked change in the differences in participation rates by level of family income over the past 10-15 years.

The earliest example of the "new merit aid" in the U.S. was the HOPE ("Helping Outstanding Pupils Educationally") Scholarship program sponsored by the State of Georgia in

1993. HOPE scholarships cover tuition, fees and book expenses for all eligible Georgia high school graduates enrolled in degree granting programs at publicly-funded two-year and four-year institutions in Georgia. HOPE scholars may also receive an award to attend a private degree granting institution in Georgia. Eligibility requires high school graduation with a "B" average and scholarships are retained if a B average is maintained. A household income cap was eliminated in 1995. HOPE has now been copied by over a dozen states.

With regards to the first question that we pose in this paper, the U.S literature generally finds that merit aid attracts more students to the institutions (states) that offer it. There is less agreement on the source of such increased enrolments. Cornwell, Mustard and Sridhar (2006, p. 784) argue that programs like HOPE "primarily affect the choice of where, rather than whether, to attend college". In contrast, Dynarski (2008) has recently argued that merit aid programs substantially increase both the proportion of students who enter college and the completion rates of entrants. With regards to the second question that we pose in this paper, Dynarski (2000) used data from the 1988-1997 Current Population Surveys for states in the south-eastern U.S. and finds that HOPE increased the college attendance rates of all 18-19 year olds in Georgia by 7 percentage points. She also found that this positive impact was limited primarily to youth from middle- and upper-income families and was greater among whites than among blacks. In a subsequent paper, however, Dynarski (2004) attributed these two findings to relatively stringent academic requirements of the HOPE program and a now-changed provision that directed more generous scholarships to higher-income students. She also reports that most merit aid programs have actually narrowed the enrolment gaps between racial groups. We have been unable to find any papers subsequent to Dynarski (2000) that focus specifically, as does ours, on differences by family income in the impact of merit aid on

student enrolments. With regards to the third question that we pose in this paper, Cornwell and Mustard (2001) and Rubenstein and Scarifidi (2002) find that the distribution of the HOPE scholarship benefits is regressive in that expenditures from the HOPE program by county are positively correlated with the level of per capital income.

3. The Ontario University System

3.1 Tuition and Entry Scholarships

Virtually all universities in Ontario are publicly funded. The two privately-funded universities in Ontario account for less than 1% of total enrollment in the province.[1] The universities range in size from a few thousand students in primarily undergraduate institutions to more than 50,000 in the major institutions. Variation in the quality of both programs and students exists but is limited. For example, the most recent information in Maclean's university rankings indicates that the mean grade point averages of entering students range from 77 to 88 percent across the universities. All tuition fees were regulated in Ontario prior to the mid-1990s. Subsequently, a deregulation process started to allow individual institutions some freedom to set their own fees. Deregulation was quite limited in general arts and science programs but was substantially more relaxed in professional programs, the two most prominent of which at the undergraduate level are Commerce and Engineering. (See Frenette (2005) for a study of fee deregulation in postgraduate professional programs such as law and medicine).

[1] Calculated by the authors from enrolment data provided on the websites of the private universities and the annual universities issue of Maclean's magazine. For convenience, we henceforth use the term "Ontario university" to refer to the publicly-funded universities in the province.

As indicated in the Introduction, the Ontario university system is quite self-contained. This feature does not result from higher tuition for "out-of-province" students. Canadian out of province students pay tuition that is either the same as or only slightly higher than that charged "in-province" students. (Fee differences for international students are much larger.) Tuition for Arts and Science programs in Ontario was about 15% higher than the Canadian average throughout our data period. The same was true for Commerce and Engineering at the start of our sample period but this differential increased to 40% following deregulation. The highest tuition in Canada is in Nova Scotia and the lowest is in Quebec. More important reasons for the self-contained nature of the Ontario system include the concentration of almost 40% of Canada's population in Ontario, the large travel distances between provinces, and the Francophone character of most universities in Quebec which is the second largest province and the nearest neighbor to most of Ontario's population.

Figures 1a and 1b provide information concerning tuition and mandatory fees that has been assembled from a variety of data sources including the Council of Ontario Universities, university web sites, and the Statistics Canada Survey of Tuition and Living Costs. (For the editor and referees, Table A-1 in the Appendix is the basis for these figures.) Figure 1a provides the maximum, minimum and 25th, 50th and 75th percentiles of tuition and fees for students in programs in the Arts (Humanities and Social Sciences) and Sciences in 2001 Canadian dollars.[2] The dollar values of each of these characteristics of the distribution increased by about 50% over our data period. The range was $585 in 1994 and increased to

[2] All dollars are 2001 Canadian dollars. The US-Canada exchange rate varied substantially over our data period.

$801 by 2005. Figure 1b provides the same information for Commerce and Engineering.[3] In this case, the effect of deregulation is more apparent. The values of both the 75th percentile and the maximum value double while the increase is just over 50% at the 50th percentile and below. The range grew from $1245 to $4002 and the inter-quartile range increased from $228 to $1777 which is much larger than the inter-quartile range of $265 for Arts and Sciences in 2005.

Financial support for students has a number of sources, some at the institutional level and some at provincial or national levels. Ontario students can apply to a single source, the Ontario Student Assistance Program (OSAP), for provincial and federal grants and loans. Students are awarded financial support based on costs, student savings, student earnings and parental income. Loans are interest-free while the recipient is a student and repayable only after graduation or discontinuing study. Awards are portable between universities and programs though a cost of living allowance is added for students at schools more than 40 km. (25 miles) from home. There are also portable entry scholarships and bursaries provided by high schools and private donors.

Over our data period, Ontario universities substantially increased financial aid and new undergraduate scholarship support has primarily been in the form of automatic merit based scholarships. The federal and Ontario governments have also expanded the amounts of repayable and non-repayable (grants, bursaries and scholarships) aid available to university students. Both OSAP and the Ontario universities make strong efforts to ensure that financial aid from these two sources supplement rather than replace each other. This is especially true in the case of non-repayable forms of aid. To this end, the formula used to determine the amount

[3] For each university and year, the level of tuition and fees are identical for Arts programs and Science programs. The same is not true for Commerce and Engineering programs. The distribution of tuition and fees within these latter two programs are very similar, however, and this is why we have combined them in Figure 1b.

of repayable and non-repayable aid to which a student is entitled incorporates substantial exemptions for merit based entry awards. In almost all cases, a merit-based entry scholarship will not reduce the amount of non-repayable aid available from government sources.[4]

We have collected individual scholarship data from a variety of sources including the annual INFO publication of the Ontario Universities Application Centre, the Maclean's Magazine Annual Report on Universities, individual university web sites, and personal communications with university administrators. The proportion of university budgets devoted to scholarships and bursaries increased from 3.1% on average in 1994 to 5.2% in 1999 and to 10.7% in 2005. Some of this increase was due to a requirement of the funding Ministry that tuition increases be accompanied by increased student support. The Ministry placed few restrictions, however, on the manner in which additional funds for scholarships were to be allocated. The proportion of university budgets devoted to student services also increased but by a smaller amount from 4.5% on average in 1994 to 6.3% in 2005.

The number of universities that offer merit-based entry awards for students with a GPA of 80 and above rose from 2 in 1994 to 13 (out of a total of 19) in 2005 and the number with an award for students with a GPA of 90 and above rose from 10 to 16. At all institutions, the value of merit entry awards is the same across programs. We have calculated the expected value (base year2001) of a guaranteed entry scholarship for a student in the grade ranges of 80 to 90 and 90 to 100 at each university including those that offer no guaranteed merit aid.[5] This expected value takes into account each university's scholarship value at each GPA level and

[4] The principal exception would be a student who receives both a merit based entry scholarship from the university and a scholarship from some other non-governmental source. The current values of the exemptions for merit scholarships are $4400 for the federal and $3500 for provincial aid.

[5] Universities differ in their cutoff points. For some institutions, 90 means 90.0 or better whereas for others this 90 means 89.5 or better. We have followed each university's policies in our calculations but, for simplicity, use the terms 80-90 and 90-100 in our text.

the distribution of GPA's of students who actually register in the university. (For the editor and referees, Table A-2 in the Appendix contains these figures.) For the 80-90 grade range, the median scholarship increased from $0 to $571 over our data period and the inter-quartile range grew from $216 to $954. In the 90-100 grade range, the median almost doubled from $1156 to $2023 but the inter-quartile range actually decreased from $1734 to $1067.

The key price variable that we use in our multivariate analysis is "net cost" which we have defined as tuition and mandatory fees minus the expected value of a guaranteed entry scholarship for a student in the relevant grade range. Figure 2a provides the maximum, minimum and 25th, 50th and 75th percentiles for net cost for students with a GPA of from 80 to 90 in the Arts and Sciences. (For the editor and referees, table A-3 in the Appendix is the basis for these figures.) Median net cost rose by about one-third. The inter-quartile range increased from $398 to $1102 whereas the same difference for tuition and fees only rose from $188 to $265. The range in net cost was little changed at about $1800. Figure 2b provides the same information for Commerce and Engineering.[6] In this case, the inter-quartile range increased by almost $1700 from $336 to $2035 and the range by almost $3000 from $2401 to $5331. Figures 2c and 2d show the distribution of expected net costs for students in the 90 to 100 grade range. For Arts and Sciences, the inter-quartile range actually decreased slightly by about $300 from $1661 to $1364 but the range increased by over $1100 from $2292 to $3446. In the case of Commerce and Engineering, the inter-quartile range increased by almost $700 from $1596 to $2287 and the range increased by $3833 from $3119 to $6952. In summary, differences among universities in tuition and fees remained very modest in Arts and Sciences programs but grew significantly in the cases of Commerce and Engineering. In all programs,

[6] As in Figure 1b, we have combined the distributions for Commerce and Engineering because the individual distributions are so similar.

however, there were substantial increases in the differences among universities in the net cost for academically strong entering students.

3.2 Our Sample

All applicants to Ontario universities from Ontario high schools submit a common form to the Ontario Universities Application Centre in which they rank their choices of programs. Both mature Ontario applicants and non-Ontario applicants follow a different application procedure, are relatively small in number, and come from very heterogeneous academic backgrounds. The application information and marks (provided directly by Ontario high schools) are forwarded by OUAC to each program and institution of choice, and OUAC later receives confirmation of the university, if any, at which the student has registered. Our OUAC data file contains information about applications and registrations at Ontario universities, high school grades, and the student's postal code at the time of application.

Our full OUAC data set contains the records of all Ontario high school students who applied for admission to start in the fall of 1994 through the fall of 2005. For this paper, we have chosen the subset of applicants who registered at an Ontario university during that time period. We have also restricted our sample to those registrants who were students in high schools that offered the standard academic curriculum and who registered initially in a full-time degree program. These two restrictions eliminated only 3.1% of registrants leaving a sample of 537,801. The restriction to schools with the standard academic curriculum means that we exclude students from such heterogeneous educational backgrounds as adult education centers, treatment schools, night schools, and special education schools. Our sample includes

students from the secular school system, the publicly-funded separate (Roman Catholic) school system and a small number of privately-funded high schools. The purpose of our restriction to registrants in full-time degree programs was to focus on students with relatively homogeneous educational aspirations.

Our data period witnessed a major secondary curriculum change that shortened the number of years of high school for university bound students from five years to four. This resulted in two cohorts of high school students having a normal graduation date in June of 2003 (commonly known as the "double cohort" year). Under the pre-2003 system, students would normally progress to university after 13 years of schooling, but outstanding students could proceed after 12 years and some students would take 14 years. After the curriculum change, it became very difficult to graduate before the normal time of 12 years but it was still possible and not uncommon to take an extra year.

Table 1 provides basic summary statistics on our sample. Column 2 indicates that the number of registrants was relatively stable in the 1990's but started to increase markedly in 2002 both in absolute terms and as a percent of 19 year olds (see column 3) with what appears to be the arrival of an unusually large number of students who completed an academic high school degree in only four years under the old system to avoid the "double cohort" year. The number of registrants declines after 2003 but remains substantially above the levels at the turn of the century. The number of registrants in 2004 (relative to 2001 or even to 2002) likely reflects some students who postponed registration for a year in order to avoid the big entry cohort of 2003. The effect of the double cohort is also shown in Column 3 where the ratio of registrants to 19 year-olds grew from about 26% to 30%. One feature of our data that changed little over our sample period was the fraction of applicants who register (not shown in Table 1)

which stayed constant at about 70% with much higher percentages (85 to 86%) for students with averages of 80 and over and 90 and over.

Columns 4 and 5 of Table 1 demonstrate the increasing proportions of students being awarded high school grade averages of 80% or better and 90% or better.[7] This suggests some grade inflation given that the same or an increasing fraction of the relevant age group registers each year (except for the 2003 to 2004 drop after the double cohort year). The noticeably improved grades in the double cohort year of 2003 likely reflect both increased selectivity as universities select the better applicants and some additional grade inflation. That the higher marks seem concentrated in the 80s and not the 90s suggests that it is mainly selection.[8]

The second of the three questions that we are considering in this paper is whether or not the responsiveness of academically strong students to merit entry scholarships varies by socioeconomic background. The third of the three questions that we are considering is whether or not the benefits of merit aid are conferred disproportionately on students from different socioeconomic backgrounds. The OUAC data do not contain family income information but they do contain the postal code that can be linked to the 2001 Census Dissemination Area (DA) in which the family resides. The DA is a small, relatively stable geographic unit with a population of 400 to 700 persons. It is the smallest standard geographic area for which all Canadian census data are disseminated. In order to consider socioeconomic differences among OUAC applicants and registrants, we first calculated the equivalent average household income[9]

[7] Grade averages (GPAs) are calculated from grades submitted by the high schools to the Application Centre. These are calculated as the average of the best 6 courses needed for university admission in Ontario.
[8] If teachers were giving better grades to 'help' students in the double cohort year one might have expected the increases to have been throughout the distribution.

[9] Equivalent average household income is equal to average household income divided by the square root of the average number of persons per household in the DA. This is analogous to a common measure of equivalent household income, that is, household income divided by the square root of the number of persons in the household.

in each DA. We then determined the 33rd ($53,500) and 67th ($77,000) percentiles of the distribution of all postal codes in Ontario when ranked by the equivalent average household income of the 2001 Census Dissemination Area with which the postal code is most strongly associated.[10] The resulting terciles are labeled as low, middle and high-income. To keep the ranking of the postal codes constant over the data period, we rely on the average income data as provided in the 2001 Census.[11]

The third of the three questions that we pose in this paper concerns the distribution of the benefits of merit aid across students from different socioeconomic backgrounds. Our data reveal that university registrants come disproportionately from higher income neighbourhoods. In 2001, 40% of all Ontarians age 15-24 lived in low-income DA's and 35% in high-income DA's. In the same year, only 22% of registrants in our data set lived in low-income DA's and 45% lived in high-income DA's. This result is consistent with the findings from HOPE and other U.S. merit aid programs (Cornwell and Mustard 2001 and Rubenstein and Scarifidi 2002). Our data, however, also permitted us to calculate the proportions of students with grade averages of 80% or better and 90% or better (as in Columns 4 and 5 of Table 1) by DA income tercile. When we did so (not shown here), we found very similar results for low, middle and high income neighborhoods. (For the editor and referees, please see table A-4 in the Appendix.) In most years, the difference between low-income and high-income neighborhoods in the proportion of registrants with a GPA of 90 and over is 1-2 percentage points. In the case of registrants with a GPA of 80 and over this difference is slightly larger in absolute terms (3-4 percentage points) but about the same in relative terms. These differences show no sign of an

[10] Some postal codes cross DA boundaries but our data identify that DA which contains the largest proportion of the population of the postal code. The approximate 10th, 25th, 50th, 75th and 90th percentiles of the distribution of average DA family incomes in 2001 dollars are as follows: $39,000, $49,000, $64,500, $84,500, and $109,000.
[11] This might havc raised concerns if the tercile ranking changed significantly over time but it does not as we found by comparing the 2001 terciles with terciles based on the 1996 census. They were very similar.

upward trend over time. Hence, merit aid appears to favour more economically privileged students in Ontario largely because such students are more likely to attend university. Conditional on registration, however, the differences in the proportions of students from low-income and high-income areas that would qualify for a merit-based entry scholarship at a given university are small. (The same is true of applicants.) A different picture might be painted, of course, by a data set with information on total scholarship aid granted and/or individual family income.

4. Multivariate Analysis

In this section we present regression estimates of the impact of net cost on the share of high-performing registrants that a university is able to attract. Table 2 illustrates the distribution of these shares across universities for 1994 and 2005 which are typical of other years in our sample. The mean share for Arts, Sciences and Commerce is 5.3% or simply one divided by the number of universities (19).[12] The mean share for Engineering is either 7.7% or 7.1% because five universities do not have this program and one initiated its first Engineering program in 2001.[13] The Engineering students are somewhat more concentrated than students in other programs. We also note that the raw data reveal frequent changes in the ordering of the universities by share of students including which university lies in first place. As indicated by Table 2, the value of the shares of students across universities varies considerably and,

[12] Brock, Carleton, Guelph, Lakehead, Laurentian (including Algoma), McMaster, Nipissing, Ottawa, Queen's, Ryerson, Toronto (Mississauga), Toronto (St. George), Toronto (Scarborough), Trent, Waterloo, Western Ontario, Wilfred Laurier, Windsor, and York.

[13] Brock, Nipissing, Toronto (Scarborough), Trent, and Wilfred Laurier do not have Engineering programs. York initiated an Engineering program in 2001.

hence, we use the natural logarithm of this proportion as the dependent variable in our regressions.

Our expectation is that students from low-income areas would be more sensitive to price than would students from high-income areas. Hence, we include dummies for these variables interacted with net cost in our regressions. We also include measures of three additional determinants of a university's share of registrants. One is a dummy variable indicating whether or not the student lives within 40 kilometres (about 25 miles) of the university at which she registers as measured by the centroids for the postal code of the student's permanent residence. Forty kilometres is the distance that the Ontario Student Assistance Program[14] uses to distinguish between commuting and non-commuting students in its aid formula. Fifty-two percent of students in our sample have permanent residences 40 kilometres or more from their university and this changed little over our sample period.

We also use two measures from the annual Maclean's issue on Canadian universities that may be especially relevant to students, namely, the proportion of the operating budget that the university spends on scholarships and bursaries and the proportion of the operating budget that the university spends on student services. Over our sample period the mean value of the former proportion increased from 3.1% to 10.7% and the mean value of the latter proportion from 4.5% to 6.3%. [15]

[14] The Ontario Student Assistance Program (OSAP) is the provincial agency that disburses bursaries and loans to students in Ontario. A student selecting a university more than 40 kilometres from his or her home is eligible for a living allowance,

[15] As noted in Section 2, three previous papers have used the rankings of universities by Maclean's magazine in their analyses. We do not do so for three reasons. First, the Maclean's rankings are within three categories: Medical/Doctoral, Comprehensive and Primarily Undergraduate. There is no ranking of universities across the categories. That is why two of the previous papers used rankings within categories and the third analysed the impact of changes in rank. We do not believe that either strategy is appropriate for our analysis. Our interest is in academically strong students who would typically meet the admission and entry award qualifications at a wide range of institutions and, hence, be considering options across the Maclean's categories. In addition, we focus on the cost of attending different institutions. Students are concerned with the level of such costs and not recent

Due to the large differences in net cost for students with different grades, we estimate separate regressions for students in two different ranges of GPA: 80-90 and 90-100. We also estimated these regressions separately by program due to the differences in tuition and grade distributions across programs. For example, engineering programs tend to be both costly and attract students with high grades, a fact that might lead a simple regression with all programs combined to indicate, erroneously, that high cost attracts more good students. Students in Arts and those in Science face similar tuition and fee schedules but have different GPAs and, hence, different expected entry scholarships. For each grade range (80-90 and 90-100) and academic program (Arts, Science, Commerce and Engineering) we estimate the following regression equation:

(1) $\text{Ln (Prop)}_{ijkt} = \beta_0 + \beta_1 \text{ Ln Relative Net Cost}_{it} + \beta_2 \text{ Ln Relative Net Cost}_{it}\text{*Low Income} + \beta_3 \text{ Ln Relative Net Cost}_{it}\text{*High Income} + \beta_4 \text{ Low Income} + \beta_5 \text{ High Income} + \beta_6 \text{ Distant} + \beta_7 \text{ Ln Prop Scholarships}_{it} + \beta_8 \text{ Ln Prop Student Services}_{it} + \beta_9 U_i + \varepsilon_{ijkt}$ where

Prop_{ijkt} = proportion of the annual total of registrants at the i^{th} university and in the j^{th} neighbourhood income category (high, middle, low), the k^{th} distance-to-university category (more than 40 kilometeres or not), and the t^{th} year. Formally, $\text{Prop}_{ijkt} = \text{Reg}_{ijkt} / (\sum_{ijk} \text{Reg}_{ijkt})$

where Reg stands for the number of registrants.

Relative Net Cost_{it} = net cost (tuition plus mandatory fees minus expected[16] value of a guaranteed entry scholarship) at the i^{th} university in the t^{th} year relative to the provincial average net cost for the same year (and program and grade range).

Low Income = dummy variable equal to 1 for low neighbourhood-income categories and equal to 0 otherwise

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changes therein. Second, the Maclean's rankings are quite stable over our data period. We wish to include a university fixed effect in our regressions to control for unobserved and unchanging institutional characteristics. These fixed effects and the Maclean's rankings are quite collinear. Third, we have divided the University of Toronto into its three separate campuses for our analysis. We believe that this approach is clearly justified indicated by the separate admissions procedures and differences among entering students at these campuses. Maclean's, however, does not provide separate rankings for these three campuses.

[16] See the earlier discussion on page 8 about what is meant by 'expected' in this context.

High Income = dummy variable equal to 1 for high neighbourhood-income categories and equal to 0 otherwise

Distant = dummy variable equal to 1 for the "live 40 kilometres or more away" category and equal to 0 otherwise

Prop Scholarship $_{it}$ = proportion of the operating budget spent on scholarships and bursaries at the i^{th} university in the t^{th} year

Prop Student Services$_{it}$ = proportion of the operating budget spent on student services at the i^{th} university in the t^{th} year

U_i = vector of dummy variables for each university (save that in omitted case), the estimates for which are not reported in this paper due to the nature of our data sharing agreement.

ε_{ijkt} = error term

There are no time dummies in the regression due to the nature of our dependent variable. In each year and grade range, there are 114 observations (19 universities, 2 distance categories and 3 income categories) for Arts, Science and Commerce. Engineering has 78 observations (13 universities) prior to 2001 and 84 observations (14 universities) thereafter. Arts, Science, Commerce and Engineering are by far the largest categories in the classification system for academic programs recognized by OUAC. However, there are other categories such as Architecture, Nursing, Education and Agriculture. For the regressions reported below, we have assigned all registrants in our sample to one of our four basic programs. For example, Nursing and Agriculture registrants were reassigned to Science and Architecture registrants were reassigned to Engineering. We have also estimated the same regressions as in Table 3 using only those registrants whose initial classification was one of Arts, Science, Commerce and Engineering. These more narrowly defined samples yielded very similar estimates to those reported below.

Before proceeding to the regression results, it is appropriate to discuss several limitations of our analysis. Universities compete vigorously for academically strong students for many reasons including the fact that such students are more pleasant to teach, help weaker students, strengthen the university's appeal to donors, and will ultimately become, on average, more influential and affluent alumni. Entry scholarships provide only one method of competing for such students. Alternative methods include other types of scholarships and bursaries, the quality and diversity of academic programs, co-op programs, and many non-academic features of university life such as preferred access to student housing, athletic and social facilities, exchange programs, etc. All such lures are costly and a decision to spend more on entry scholarships must, at least in some short run, lead to tradeoffs with other costs or services. As indicated above, our expectation is that entry scholarships would be more effective in attracting students from lower income backgrounds. The corollary of this expectation is that students from higher income backgrounds will give relatively greater weight to the other features of university life listed above.

One shortcoming of our analysis is that we do not have good measures for many of the factors other than entry scholarships that likely influence the enrolment decisions of academically strong students. This shortcoming is typical of the literature cited in our review in Section 2. A second shortcoming of our analysis is that of possible endogeneity, that is, a university may decide to initiate or enrich entry scholarships as a consequence of a declining share of academically strong students. In constructing our data set we have been careful to match the timing of the variables so as to minimize this problem, i.e., the net cost variable is based on the tuition, fees and scholarships that students would have observed at the time of application in a given year. We believe that both of these problems also characterize much of

the literature in this area. For example, the initiation of the HOPE scholarships (or similar scholarships in other states) can be thought of as an policy change (possibly in response to enrolment trends) that altered the terms of competition for good students both among universities in Georgia and between universities in Georgia and other regions that traditionally attracted students from Georgia. We would expect that both Georgia universities and their traditional competitors would alter other aspects of their costs, programs and services in an effort to maintain and increase their share of strong students.

Papers in the HOPE literature have at best very limited measures of the changes in such university costs, programs and services that were induced by the institution of the HOPE and related scholarships. Similarly, our sample period witnessed a major policy change in Ontario, that is, the institution of tuition and fee deregulation and the accompanying requirement to allocate a certain fraction of revenues to financial aid. This policy change, in turn, has altered the terms of competition for good students among Ontario universities and stimulated a series of changes in the various programs, services and costs that these universities use to attract such students. As in the HOPE literature, our ability to measure and model the effects of the various university responses to the initial public policy change is limited. Also as in the HOPE literature, the problem of identifying the causal effects of changes in scholarship policy at either the university or state level is one not easily solved with the available data..

We report the regression results for registrants in Arts and Sciences programs in Table 3 and for registrants in Commerce and Engineering in Table 4. Our pattern of reporting is the same across all four programs. In the first two columns we report the results for the registrants with a high school average in the 80-90 range and in the last two columns we report the results for the registrants with a high school average in the 90-100 range. For each grade range, we

report the results from two specifications. The first specification allows the net cost measure to have a similar effect across all groups of students. The second specification allows the net cost to have a different effect across the three income groupings (low, middle, and high). We have measured both the dependent variable and the continuous independent variables in natural logarithms and, hence, can interpret the coefficients as elasticities, that is, the relative proportionate changes in the dependent and independent variables. In the text, we shall refer to estimates with a p-value of 0.10 or less as "significant".

The coefficients for the non-cost variables in Tables 3 and 4 are, in most instances, quite similar. Hence, we will comment on them before moving on to consider the net cost coefficients. The first non-cost variable is an indicator of the type of neighborhood from which a registrant has come (low, middle or high income). We use the middle income neighborhood as the omitted category. Across all specifications and programs, the sign of the coefficients are similar. The coefficients for the low-income dummy variable are always significantly negative and imply that registrants from these neighborhoods, other things equal, constitute a proportion of students in this grade range that is from 50% to 80% smaller than that of the students from middle-income neighborhoods. In contrast, the high-income neighborhood coefficients are usually close to zero in value and not significantly different from the omitted category (middle income). The one exception is in the case of Science students for whom the high-income neighborhood coefficients are significantly negative but still small in absolute value.

We also include a measure based on the students' home residences being within 40 kilometers of the university. For the Arts programs, students whose home residence is more than 40 kilometres from their university constitute a significantly greater share of registrants in both grade ranges than do students who live closer to campus. For other programs, however,

the distance coefficient is not significant for the 80-90 grade range and is significantly negative for the 90-100 grade range. Hence, there is no consistent pattern for this variable. The coefficients for the proportion of operating budgets spent on scholarships and the proportion spent on student services are usually positive, as expected, but small and not significant. The only exceptions are the (positive) coefficients for the proportion of operating budgets spent on scholarships on the share of Science students in the 90-100 grade range and the proportion spent on student services on the share of Commerce students in 90-100 grade ranges.

We now turn to the cost coefficients and begin with the specification that allows the net cost to have a similar effect across all groups of students in the 80-90 range (column 1 for each of the programs). Across all of the specifications, this coefficient is positive but not significantly different from zero. In contrast, the coefficient on the net cost measure for the students in the 90-100 range (column 3), is negative and statistically significant. For Arts, Science, and Commerce, the cost elasticity is modest ranging from -0.085 to -.129. The cost elasticity is quite large for Engineering, -0.86, indicating that registrations in Engineering programs are quite sensitive to changes in the relative tuition cost. Hence, the answer to the first of the three questions that we are considering in this paper is that, with one exception, merit scholarships have at most a small effect on the ability of an individual university to increase its share of academically strong students. As indicated in Section 2, the U.S. literature has generally found that merit aid does have an impact of where students attend university.

When allow the effect of the net cost to vary across the income groupings, we observe significant differences in the cost elasticities. Across all programs, the coefficient on net cost (row 1) reflects the effect of change in the net cost for registrants from middle income neighborhoods. The additional effect for low income neighborhoods is reported in row 7 and

the additional effect for high income neighborhoods is reported in row 9. For ease of interpretation, we report in rows 8 and 10, respectively the total effect (row 1 plus either row 7 or row 9) of a change in net cost for these income groups. In row 11, we report the difference between the high and low income interaction coefficients (row 9 minus row 7).

For Arts students in the 80-90 grade range, the net cost effect for the middle income is not significant. For the low income group, both the interaction coefficient and the total net cost effect are negative and significant with an elasticity of 0.54 when the two terms are combined. For the high-income group, the interaction coefficient and the total cost effect are positive and significant with a combined elasticity of 1.56. The difference between the interaction coefficients for the high-income and low-income neighbourhoods is positive which suggests that an increase in net cost at a university will lead to an increase in the ratio of the share of students from high-income neighborhoods to the share of students from low-income neighborhoods.

Our expectation was that a high net cost would have a more negative effect on students from low-income areas than on students from high-income areas. What Table 3 shows for Arts students in the 80-90 grade range is that a higher net cost is associated with an increased proportion of students from high-income areas. One possibility, as indicated in our discussion above, is that guaranteed entry scholarships channel funds away from other services that high-income students value more greatly, e.g., smaller classes, better facilities, etc. Note that we do include the Maclean's measures of the proportions of the operating budget devoted to scholarships and student services but these likely miss many important aspects of student life.[17]

[17] Maclean's does have measures of class size but, unfortunately, these measures are not consistent over our data period.

For Arts students in the 90-100 grade range, both interaction coefficients and total cost effects are negative though only the interaction term for the low-income students and the total net cost effect for high-income students are significant. This is the only instance in Table 3 in which the difference between the interaction coefficients is not significant and, hence, do not indicate that an increase in net cost will lead to an increase in the ratio of the share of students from high-income neighborhoods to the share of students from low-income neighborhoods.

The estimates for Science students in the 80-90 grade range are similar to those for Arts students in the same grade range in the following ways: the net cost effect for the middle income is not significant; both the interaction term and the total net cost effect are negative (positive) for the low (high) income group; and higher net cost is associated with an increase in the ratio of the share of students from high-income neighborhoods to the share of students from low-income neighborhoods. For Science students in the 90-100 grade range, the total net cost effect for students from both middle and low income neighbourhoods is significantly negative. The interaction coefficient for the high income group is positive and significantly different from zero but the total cost effect for this group is not. Once again, though, an increase in net cost is associated with an increase in the ratio of the share of students from high-income neighborhoods to the share of students from low-income neighborhoods.

The net cost estimates for Commerce students in the 80-90 grade range in Table 4 are also similar to those for Arts and Science students in the same grade range. For the low income group, the interaction coefficient is negative and almost significant by our standard (p-value = 0.11) but the total net cost effect is not significant. For the high income group, both the interaction term and the total net cost effect are positive and significant. These results suggest the familiar effect of an increase in net cost on the mix of students from high-income and low-

income neighborhoods. The results for Commerce students in the 90-100 grade range are similar to those for such students in the 80-90 grade range. The key difference is that, for the 90-100 group, the total cost effects for middle and low income groups are significant though the total cost effect for the high income group is not.

For Engineering registrants in the 80-90 grade range (Table 4), the total net cost effect is not significant for any income group. For the 90-100 students, the total net cost effects are negative and significant for the middle- and low-income groups but not significant for the high-income category. For Engineering students in both grade ranges, an increase in net cost will raise the share of students from high-income neighborhoods relative to those from low-income areas

In summary, with regard to the second of the three questions considered in this paper, the estimates in Tables 3 and 4 commonly indicate that, higher net cost is associated with a decrease in a university's share of students from low-income areas and an increase in the share from high-income areas. Our most robust finding is that a higher net cost is associated with an increase in the proportion of students from high-income areas relative to the proportion from low-income areas. Furthermore, the size of this effect is always substantially larger for the 80-90 grade range than for the 90-100 range. One possible reason for this is that universities differ less in net cost for the top grade group once non-guaranteed entry scholarships are taken into account. That is to say, many students in the 90-100 range anticipate and receive substantial scholarships whether guaranteed or not.[18] As indicated in Section 2, the U.S. literature has typically focused on racial rather than income differences in the response to merit aid. The evidence is that most merit aid programs have narrowed the enrolment gaps between

[18] We also experimented with models in which the distance dummy variable was interacted with net cost and the low-income and high-income variables. This specification increases substantially the number of parameters to be estimated and does not offer any systematic additional insights.

racial groups. This implies a more positive response to merit aid from groups with lower average income, a finding that is consistent with ours.

5. Summary and Conclusion

The past decade witnessed steady increases in the real cost of tuition and fees at Ontario universities especially in professional programs such as Commerce and Engineering. These cost hikes were accompanied by large increases in financial aid often in the form of merit-based entry scholarships. This form of financial aid was not the norm at Ontario universities in the mid-1990's but now is offered by most such institutions. Over this period there have been increases not only in the average value of such scholarships but in the variation among universities in the value of such merit aid. Virtually all Ontario universities are publicly funded and the system is quite self-contained. Hence, the main purpose of these scholarships is not to keep high ability students in the province but to attract academically strong students to the individual institution by lowering the net cost of attendance.

We use data from the Ontario Universities Application Centre on student registrations from 1994 through 2005 to examine three questions. Does a lower net cost enable an Ontario university to attract a greater share of academically strong high school students? Does the impact of net cost on attendance vary by the socioeconomic background of the student? Is merit aid of disproportionate benefit to students from more privileged socioeconomic backgrounds?

Our regression estimates indicate no significant relationship between the net cost (tuition minus merit aid) of attending a given university relative to its competitors and the overall share of high school applicants with a high school grade average in the 80-90 range that the university is able to attract. For students in the 90-100 grade range, however, we find a significant and modest-sized cost elasticity of about -0.10 in value for students in Arts, Science, and Commerce. For the Engineering students in this top grade range, however, the cost elasticity is -0.86. Hence the answer to our first question is that, with one exception, merit scholarships have at most a small effect on the ability of a university to increase its share of academically strong students.

To answer our second question, we also estimated our regressions with interactions between net cost and the average income level of the neighbourhood in which the student's family resides. In the majority of cases, we find higher net cost is associated with a decrease in a university's share of students from low-income areas and an increase in the share from high-income areas. One interpretation of the positive effect of higher costs on students from high-income neighbourhoods is that guaranteed entry scholarships channel funds away from other services that high-income students value more greatly, e.g., smaller classes, better facilities, etc. Our most robust finding is that a higher net cost is associated with an increase in the proportion of students from high-income areas relative to the proportion from low-income areas. In other words, merit aid influences not so much the number as the type of academically strong students that a university can attract.

To answer our final question, the data reveal that university registrants do indeed come disproportionately from higher income neighbourhoods. Conditional upon university registration, however, the differences in the proportions of students from low-income and high-

income neighbourhoods that qualify for a merit-based entry scholarship at a given university is only one or two percentage points. Hence, among those students who make it to university, merit aid does not appear to be of disproportionate benefit to those from more economically advantaged backgrounds.

References

Barr-Telford, Lynn, Fernando Cartwright, Sandrine Prasil and Kristina Shimmons, (2003). "Access, Persistence and Financing: First Results from the Postsecondary Education Participation Survey (PEPS), Research Paper 81-595-MIE-No.007,*Culture, Tourism and the Centre for Education Statistics*, Statistics Canada, Ottawa.

Bowlby, Jeffrey W. and Kathryn McMullen, (2002). "At a Crossroads: First Results for the 18-20 Year Old Cohort of the Youth in Transition Survey. Research Paper 81-591-XIE, Statistics Canada.

Bouchard, Brigitte and John Zhao. 2000. "University Education: Recent Trends in Participation, Accessibility and Returns." *Education Quarterly Review*, 6, 4. Ottawa: Statistics Canada.

Canadian Association of University Teachers (2005). CAUT Almanac of Post-Secondary Education in Canada.

Canadian Information Centre for International Credentials (2006), "Postsecondary Education in Ontario", Retreived March 12, 2006 from http://www.cicic.ca/postsec/volume2/description.en.asp?code= ON.

Christofides, L., J. Cirello and M. Hoy. 2001. "Family Income and Post-Secondary Education In Canada." *Canadian Journal of Higher Education*, 3, 1: 1770-208.

Corak, Miles, G. Lipps and J. Zhao. 2003. "Family Income and Participation in Post-Secondary Education." Research Paper No. 210, Analytic Studies Branch, Family and Labour Studies Division, Statistics Canada.

Cornwell, Christopher, David Mustard and Deepa Sridhar. 2006. "The Enrolment Effects of Merit-Based Financial Aid: Evidence from Georgia's HOPE Scholarship." *Journal of Labor Economics*, 24, 4: 761-786.

Cornwell, Christopher and David Mustard 2001. "The Distributional Impacts of Lottery-Funded Aid: Evidence From Georgia's Hope Scholarship." Working paper, Department of Economics, University of Georgia.

Drewes, Torben. and Christopher Michael. 2004. "How Do Students Choose A University?: An Analysis of Applications to Universities in Ontario." Working paper, Department of Economics, Trent University.

Dynarski, Susan. 2000. "Hope for Whom? Financial Aid for the Middle Class and Its Impact on College Attendance." *National Tax Journal*, 53, 2: 629-662.

Dynarski, Susan. 2004. "The New Merit Aid". In Caroline Hoxby, ed., *College Choices: The Economics of Where To Go, When To Go and How To Pay For It*. Chicago: U. of Chicago Press.

Dynarski, Susan. 2008. "Building The Stock of College-Educated Labor." *Journal of Human Resources*, 43, 2: 576-610.

Frenette, Marc. 2005. "The Impact of Tuition Fees on University Access: Evidence from a Large-scale Price Deregulation in Professional Programs", Analytical Studies Branch Research Paper Series, Business and Labour Market Analysis Division, Statistics Canada.

King, A., W. Warren, J. Boyer and P. Chin. 2005. "Double Cohort Study, Phase 4 Report." Report for the Ontario Ministry of Education. Social Program Evaluation Group, Queen's University.

Knighton, T. and S. Mirza. 2002. "Post-Secondary Participation: The Effects of Parent's Education and Household Income." *Education Quarterly Review*, 8, 3. Ottawa: Statistics Canada.

Kong, Qi. and Michael Veall. 2005. "Does the Maclean's Ranking Matter?" *Canadian Public Policy, 31, 3*: 231-242.

Maclean's Magazine Annual Report. 1994 through 2005.

Mueller, R. E. and D. Rockerbie. 2005. "Determining Demand for University Education in Ontario by Type of Student," *Economics of Education Review*, 24: 469-483.

Rubenstein, Ross and Benjamin Scafidi. 2002. "Who Pays and Who Benefits: Examining the Distributional Consequences of the Georegia Lottery for Education." *National Tax Journa*l, 55, 2: 223-238

Statistics Canada. 2008. University enrolments, by province of residence and province of study, annual (number), 1992-1993 to 2005-2006. Postsecondary Student Information System.

Tomkowicz, Joanna and Tracey Bushnik, (2003). "Who Goes to Post-Secondary Education and When: Pathways Chosen By 20-Year-Olds", Research Paper 81-595-MIE No. 006, Centre for Education Statistics, Statistics Canada.

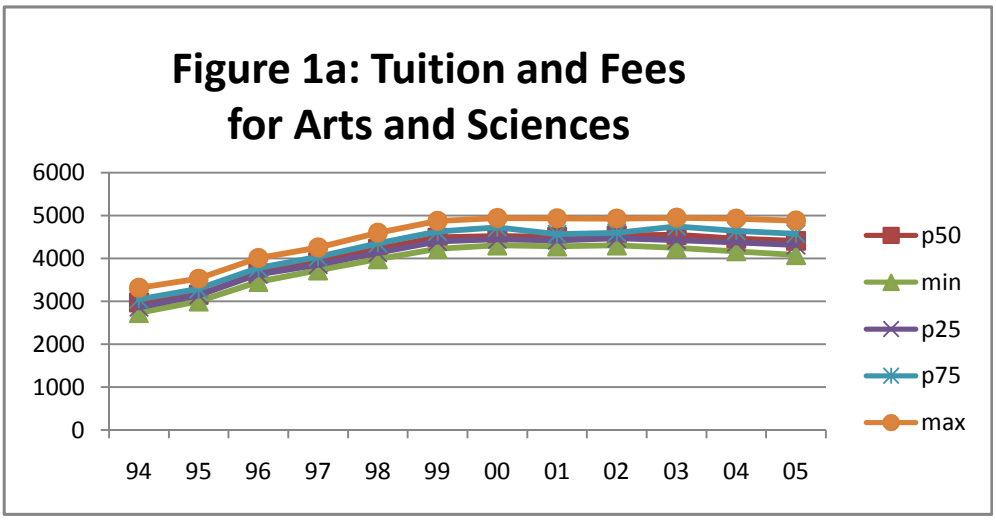
Figure 1a: Tuition and Fees for Arts and Sciences
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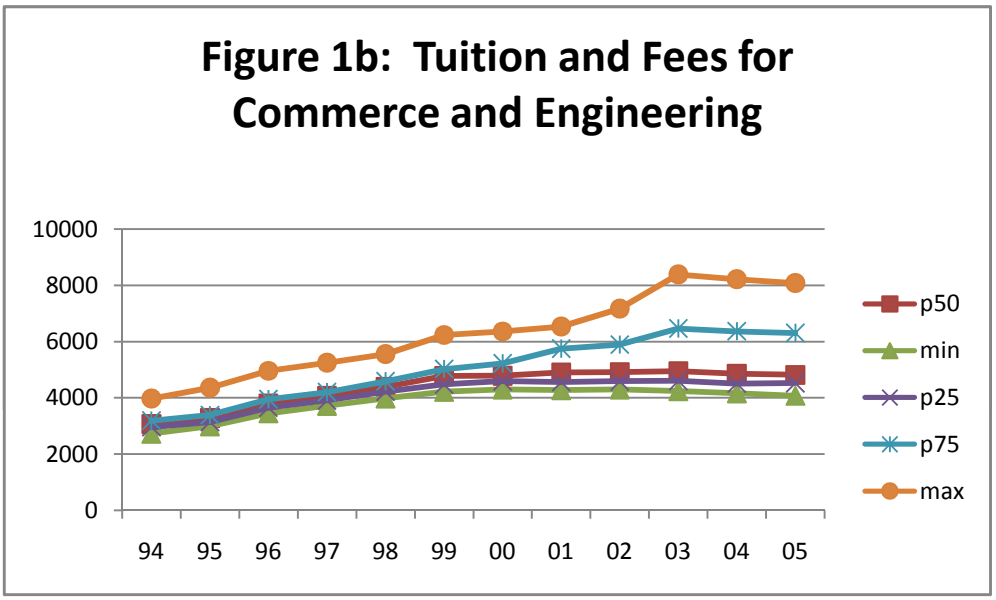
Figure 1b: Tuition and Fees for Commerce and Engineering
10000
8000
6000
4000
2000
0
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99
00
01
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04
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p25
p75
max

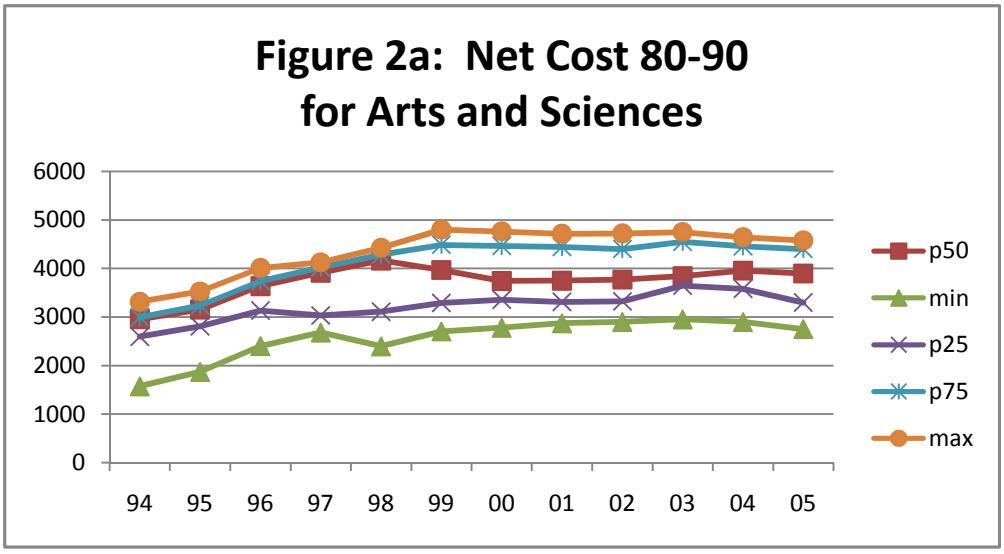
Figure 2a: Net Cost 80-90 for Arts and Sciences
6000
5000
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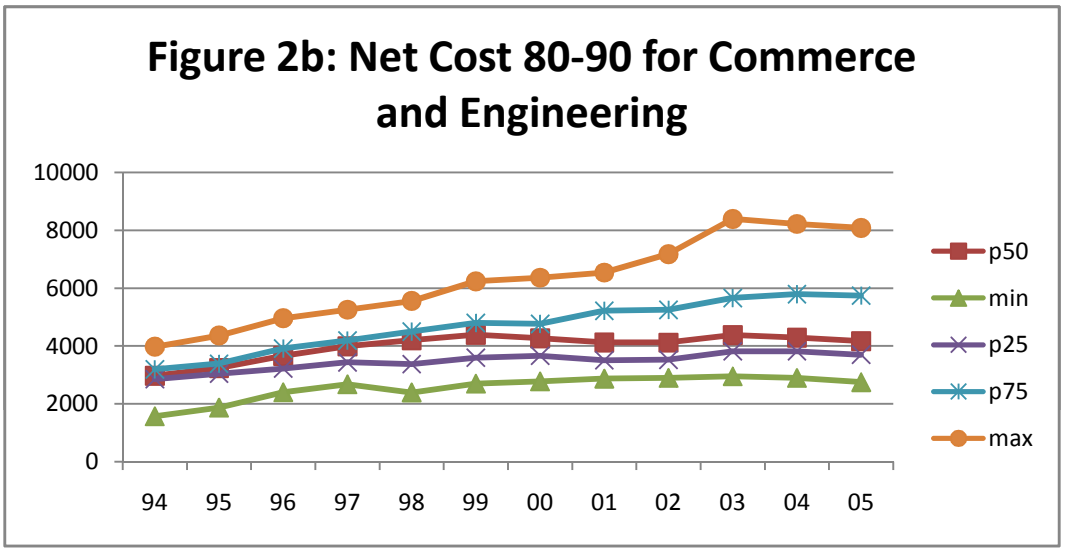
Figure 2b: Net Cost 80-90 for Commerce and Engineering
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Figure 2c: Net Cost 90-100 for Arts and Sciences

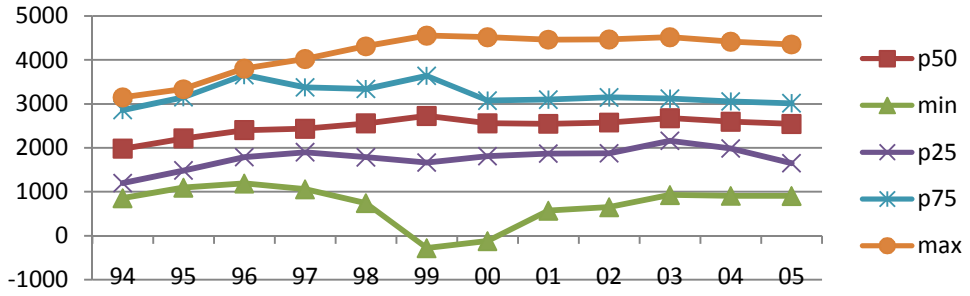

Figure 2d: Net Cost 90-100 for Commerce and Engineering

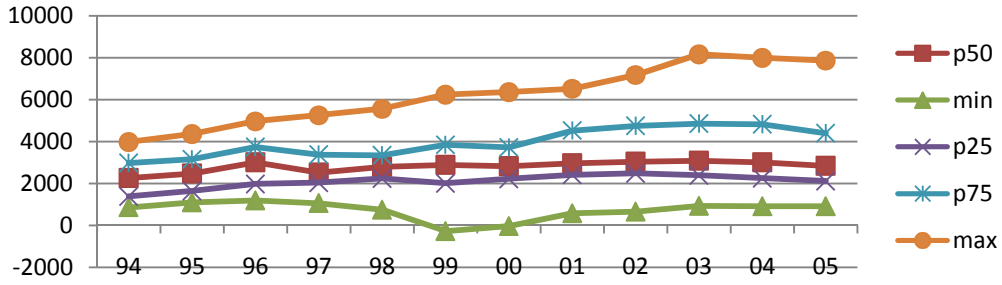

Table 1				
Year One Registrants at Ontario Universities				
(1)	(2)	(3)	(4)	(5)
Year	Number of Registrants	Registrants / 19 year olds*	% Registrants with GPA 80+	% Registrants with GPA 90+
1994	38972	27%	50%	9%
1995	38199	26%	52%	9%
1996	38933	27%	53%	10%
1997	38386	27%	55%	11%
1998	38928	26%	55%	11%
1999	41138	27%	55%	12%
2000	40250	26%	57%	13%
2001	42101	26%	57%	13%
2002	49168	30%	59%	14%
2003	68958	41%	66%	15%
2004	50552	30%	62%	13%
2005	52216	31%	62%	14%

*Number 19 year olds is from Statistics Canada Intercensal Projections.

Table 2											
Distribution of Student Shares by Grade Level, Program and Year											
		Percentiles						Percentiles			
	Min	25th	50th	75th	Max		Min	25th	50th	75th	Max
	Arts 80-90						Arts 90+				
1994	0.6%	2.2%	4.2%	6.2%	17.3%		0.0%	9.9%	4.3%	7.1%	15.6%
2005	1.0%	2.2%	5.4%	6.6%	13.7%		1.1%	13.6%	3.6%	7.9%	14.9%
	Science 80-90						Science 90+				
1994	0.2%	1.4%	3.4%	11.6%	14.8%		0.1%	0.9%	2.2%	9.9%	22.3%
2005	0.4%	1.7%	3.7%	8.6%	14.8%		0.4%	1.0%	2.6%	9.0%	19.1%
	Commerce 80-90						Commerce 90+				
1994	0.1%	2.0%	4.4%	8.4%	17.1%		0.0%	0.7%	2.3%	12.2%	22.3%
2005	0.4%	1.6%	4.9%	8.9%	11.7%		0.0%	0.6%	1.8%	9.3%	19.1%
	Engineering 80-90						Engineering 90+				
1994	0.5%	4.6%	7.1%	10.3%	20.0%		0.2%	1.8%	3.5%	7.2%	34.1%
2005	0.2%	2.0%	5.7%	9.6%	26.1%		0.2%	0.8%	2.3%	8.0%	36.7%

Table 3

Regressions for Impact of Net Cost on the Share of Registrants: Arts and Science

		(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
	Faculty	**Arts**					**Science**			
	Grade Range	**80-90**		**90-100**			**80-90**		**90-100**	
(1)	(Natural Log of) Net Cost	0.34	0.01	-0.12*	-0.05		0.28	0.30	-0.13***	-0.18***
	Relative to Provincial Average	(0.35)	(0.99)	(0.10)	(0.53)		(0.60)	(0.63)	(0.00)	(0.00)
(2)	Low Income Census Dissemination Area	-0.50***	-0.51***	-0.81***	-0.84***		-0.41***	-0.42***	-0.50***	-0.50***
		(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)
(3)	High Income Census Dissemination Area	-0.026	-0.01	-0.09	-0.11		-0.11***	-0.09***	-0.15**	-0.13*
		(0.48)	(0.84)	(0.29)	(0.27)		(0.01)	(0.01)	(0.03)	(0.06)
(4)	Lives at least 40 kilometers from campus	0.32***	0.32***	0.48***	0.48***		0.07	0.07	-0.38***	-0.38***
		(0.00)	(0.00)	(0.00)	(0.00)		(0.18)	(0.18)	(0.00)	(0.00)
(5)	(Natural Log of) Proportion of Operating	0.13	0.13	0.15	0.15		0.17	0.17	0.60***	0.60***
	Budget Spent on Scholarships	(0.14)	(0.14)	(0.51)	(0.51)		(0.31)	(0.32)	(0.00)	(0.00)
(6)	(Natural Log of) Proportion of Operating	0.04	0.04	0.27	0.27		-0.07	-0.07	0.20	0.20
	Budget Spent on Student Services	(0.60)	(0.60)	(0.22)	(0.22)		(0.75)	(0.75)	(0.24)	(0.25)
(7)	Interaction of Net Cost with Low Income		-0.55***		-0.11**			-1.17**		0.03
	Dissemination Area		(0.00)		(0.03)			(0.02)		(0.64)
(8)	Net Cost plus Low Income Interaction		-0.54*		-0.16			-0.87*		-0.15***
	(1) + (7)		(0.10)		(0.14)			(0.10)		(0.00)
(9)	Interaction of Net Cost with HIgh Income		1.56***		-0.09			1.10*		0.12*
	Dissemination Area		(0.00)		(0.29)			(0.06)		(0.06)
(10)	Net Cost plus High Income Interaction		1.57**		-0.14**			1.40*		-0.05
	(1) + (9)		(0.02)		(0.04)			(0.07)		(0.24)
(11)	High Income Interaction minus Low		2.11***		0.03			2.27***		0.10**
	Income Interaction (9) - (7)		(0.00)		(0.83)			(0.00)		(0.02)
	Number of observations	1386	1386	1386	1386		1386	1386	1386	1386
	p-values in parentheses	*p<0.10, **p<0.05, ***p<0.01								

Table 4

Regressions for Impact of Net Cost on the Share of Registrants: Commerce and Engineering

		(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
	Faculty	**Commerce**					**Engineering**			
	Grade Range	**80-90**		**90-100**			**80-90**		**90-100**	
(1)	(Natural Log of) Net Cost	0.52	0.45	-0.08**	-0.09**		0.09	0.08	-0.86**	-0.84**
	Relative to Provincial Average	(0.22)	(0.34)	(0.02)	(0.04)		(0.91)	(0.93)	(0.02)	(0.02)
(2)	Low Income Census Dissemination Area	-0.51***	-0.53***	-0.55***	-0.58***		-0.36***	-0.39***	-0.75***	-0.78***
		(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)
(3)	High Income Census Dissemination Area	0.01	0.03	-0.11	-0.09		0.06	0.09*	0.07	0.09
		(0.88)	(0.65)	(0.43)	(0.53)		(0.18)	(0.05)	(0.40)	(0.29)
(4)	Lives at least 40 kilometers from campus	-0.01	-0.01	-0.45***	-0.45***		-0.02	-0.02	-0.33***	-0.33***
		(0.87)	(0.87)	(0.00)	(0.00)		(0.75)	(0.75)	(0.00)	(0.00)
(5)	(Natural Log of) Proportion of Operating	0.24	0.24	-0.15	-0.15		-0.04	-0.04	-0.06	-0.06
	Budget Spent on Scholarships	(0.27)	(0.28)	(0.34)	(0.34)		(0.89)	(0.89)	(0.79)	(0.79)
(6)	(Natural Log of) Proportion of Operating	0.27	0.27	0.80**	0.80**		0.21	0.21	0.22	0.22
	Budget Spent on Student Services	(0.29)	(0.29)	(0.02)	(0.02)		(0.28)	(0.28)	(0.42)	(0.42)
(7)	Interaction of Net Cost with Low Income		-0.61		-0.13*			-0.77		-0.26
	Dissemination Area		(0.11)		(0.06)			(0.14)		(0.29)
(8)	Net Cost plus Low Income Interaction		-0.16		-0.22*			-0.69		-1.09**
	(12) + (18)		(0.77)		(0.00)			(0.34)		(0.02)
(9)	Interaction of Net Cost with HIgh Income		0.83**		0.13*			0.79*		0.19
	Dissemination Area		(0.02)		(0.10)			(0.06)		(0.49)
(10)	Net Cost plus High Income Interaction		1.28		0.05			0.87		-0.65
	(12) + (20)		(0.01)		(0.49)			(0.20)		(0.11)
(11)	High Income Interaction minus Low		1.44**		0.27**			1.55**		0.44*
	Income Interaction (20) - (18)		(0.01)		(0.01)			(0.00)		(0.10)
	Number of observations	1386	1386	1386	1386		966	966	966	966
	p-values in parentheses	*p<0.10, **p<0.05, ***p<0.01								

Table A-1a

Tuition and Fees for Arts and Sciences (CDN$2001)

	mean	p50	min	p25	p75	max	p75-p25	max-min
94	2982	2975	2730	2860	3048	3315	188	585
95	3194	3154	2997	3140	3290	3530	150	532
96	3690	3658	3453	3630	3779	4010	149	557
97	3962	3915	3724	3849	4037	4253	188	529
98	4247	4224	3985	4132	4354	4595	223	611
99	4521	4487	4220	4393	4626	4873	233	653
00	4562	4520	4304	4444	4724	4941	280	637
01	4526	4504	4278	4416	4570	4933	154	655
02	4543	4539	4303	4467	4597	4930	130	627
03	4569	4551	4245	4424	4746	4949	322	704
04	4499	4459	4165	4372	4644	4928	272	763
05	4444	4411	4080	4311	4576	4882	265	801

Table A-1b

Tuition and Fees for Commerce and Engingeering (CDN$2001)

	mean	p50	min	p25	p75	max	p75-p25	max-min
94	3107	3071	2730	2968	3196	3975	228	1245
95	3321	3290	2997	3152	3395	4363	244	1366
96	3833	3806	3453	3658	3955	4962	297	1509
97	4117	4078	3724	3915	4211	5253	296	1530
98	4440	4399	3985	4231	4595	5559	364	1574
99	4878	4781	4220	4487	5030	6237	543	2017
00	4971	4795	4304	4598	5231	6362	633	2058
01	5146	4904	4278	4570	5753	6537	1183	2259
02	5272	4920	4303	4597	5896	7176	1299	2873
03	5580	4954	4245	4613	6469	8393	1857	4148
04	5491	4864	4165	4511	6371	8219	1860	4054
05	5414	4823	4080	4530	6307	8082	1777	4002

Table A-2a								
Expected Scholarship 80-90 for All Programs (CDN$2001)								
	mean	p50	min	p25	p75	max	p75-p25	max-min
1994	171	0	0	0	216	1156	216	1156
1995	166	0	0	0	211	1128	211	1128
1996	257	0	0	0	561	1111	561	1111
1997	313	0	0	0	770	1091	770	1091
1998	472	209	0	0	1021	1598	1021	1598
1999	615	700	0	0	1060	1567	1060	1567
2000	726	879	0	212	1093	1524	881	1524
2001	721	858	0	144	1182	1478	1038	1478
2002	715	841	0	141	1158	1448	1018	1448
2003	609	631	0	137	955	1291	818	1291
2004	566	582	0	135	916	1448	782	1448
2005	632	571	0	132	1086	1467	954	1467
Table A-2b								
Expected Scholarship 90-100 for All Programs (CDN$2001)								
	mean	p50	min	p25	p75	max	p75-p25	max-min
1994	956	1156	0	0	1734	2139	1734	2139
1995	933	1128	0	0	1692	2087	1692	2087
1996	1049	1111	0	0	1906	2446	1906	2446
1997	1416	1500	0	660	2182	2728	1522	2728
1998	1676	1730	0	865	2354	3243	1490	3243
1999	1977	1818	0	961	2807	4770	1846	4770
2000	2047	2062	0	1547	2730	4640	1184	4640
2001	1873	2000	0	1500	2645	4000	1145	4000
2002	1836	1960	0	1470	2593	3920	1123	3920
2003	1802	1910	0	1433	2346	3820	914	3820
2004	1801	1954	0	1406	2343	3748	937	3748
2005	1921	2023	223	1379	2446	3676	1067	3453

Table A-3a								
Net Cost 80-90 for Arts and Sciences (CDN$2001)								
	mean	p50	min	p25	p75	max	p75-p25	max-min
94	2811	2957	1574	2597	2995	3315	398	1741
95	3027	3154	1870	2812	3238	3530	426	1659
96	3433	3638	2402	3136	3738	4010	602	1608
97	3649	3915	2682	3035	4024	4128	989	1446
98	3775	4165	2396	3111	4284	4427	1173	2030
99	3906	3969	2704	3290	4487	4801	1197	2096
00	3836	3744	2780	3359	4466	4764	1107	1984
01	3806	3751	2875	3313	4446	4717	1133	1842
02	3828	3771	2901	3323	4403	4719	1080	1818
03	3959	3841	2954	3649	4551	4750	902	1796
04	3933	3957	2898	3581	4459	4644	878	1746
05	3812	3897	2751	3298	4401	4576	1102	1825
Table A-3b								
Net Cost 80-90 for Commerce and Engineering (CDN$2001)								
	mean	p50	min	p25	p75	max	p75-p25	max-min
94	2958	2975	1574	2860	3196	3975	336	2401
95	3175	3238	1870	3043	3391	4363	348	2493
96	3603	3658	2402	3225	3916	4962	690	2560
97	3832	3992	2682	3441	4189	5253	748	2572
98	4000	4204	2396	3381	4503	5559	1121	3162
99	4282	4389	2704	3598	4801	6237	1203	3532
00	4285	4270	2780	3669	4764	6362	1095	3582
01	4468	4122	2875	3510	5219	6537	1709	3662
02	4597	4119	2901	3530	5248	7176	1718	4275
03	5012	4376	2954	3820	5661	8393	1841	5440
04	4957	4292	2898	3820	5792	8219	1972	5321
05	4808	4167	2751	3704	5740	8082	2035	5331

Table A-3c								
Net Cost 90-100 for Arts and Sciences (CDN$2001)								
	mean	p50	min	p25	p75	max	p75-p25	max-min
94	2026	1981	856	1199	2860	3148	1661	2292
95	2261	2213	1097	1486	3148	3335	1663	2238
96	2641	2402	1191	1788	3658	3806	1870	2615
97	2547	2435	1057	1901	3376	4023	1475	2965
98	2571	2554	742	1785	3339	4311	1554	3570
99	2544	2725	-283	1665	3639	4555	1974	4838
00	2515	2558	-120	1812	3074	4516	1262	4636
01	2653	2545	570	1868	3096	4463	1228	3893
02	2707	2574	649	1878	3148	4467	1269	3819
03	2766	2674	926	2160	3118	4518	959	3593
04	2698	2593	908	1985	3053	4417	1068	3509
05	2523	2544	908	1649	3014	4353	1364	3446
Table A-3d								
Net Cost 90-100 for Commerce and Engineering (CDN$2001)								
	mean	p50	min	p25	p75	max	p75-p25	max-min
94	2197	2257	856	1379	2975	3975	1596	3119
95	2432	2469	1097	1639	3154	4363	1515	3266
96	2847	3002	1191	1970	3739	4962	1769	3771
97	2705	2524	1057	2029	3376	5253	1347	4196
98	2806	2793	742	2233	3347	5559	1114	4817
99	2990	2884	-283	2008	3840	6237	1832	6519
00	3013	2820	-42	2218	3717	6362	1499	6404
01	3337	2957	570	2409	4525	6519	2116	5949
02	3499	3043	649	2480	4743	7176	2264	6527
03	3846	3084	926	2387	4857	8162	2470	7236
04	3741	3005	908	2245	4824	7992	2579	7083
05	3526	2837	908	2113	4401	7859	2287	6952

Table A-4						
Distribution of Registrants and Applicants by Neighbourhood Average Income:						
Overall and by Grade Category						
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Year	**Low Income***		**Middle Income***		**High Income***	
All Persons Age 15-24 in 2001 Census						
	40%		25%		35%	
All Applicants and Registrants						
Year	% Applicants	% Registrants	% Applicants	% Registrants	% Applicants	% Registrants
1994	25%	24%	34%	35%	41%	42%
1995	24%	23%	34%	34%	42%	42%
1996	24%	23%	34%	35%	42%	42%
1997	23%	23%	34%	34%	42%	43%
1998	23%	22%	34%	34%	43%	44%
1999	23%	22%	34%	34%	43%	45%
2000	22%	22%	34%	34%	43%	44%
2001	22%	22%	34%	34%	44%	45%
2002	22%	21%	33%	34%	45%	46%
2003	21%	20%	33%	33%	46%	47%
2004	22%	21%	33%	33%	46%	47%
2005	21%	20%	33%	33%	46%	47%
Applicants and Registrants with GPA 90+						
1994	21%	21%	32%	33%	48%	46%
1995	20%	20%	33%	34%	47%	46%
1996	21%	21%	33%	34%	46%	45%
1997	21%	21%	31%	32%	48%	47%
1998	20%	21%	31%	32%	49%	47%
1999	20%	20%	31%	32%	49%	48%
2000	19%	19%	32%	33%	49%	48%
2001	18%	19%	32%	33%	49%	48%
2002	19%	19%	32%	32%	50%	49%
2003	18%	19%	31%	32%	50%	49%
2004	19%	19%	31%	33%	50%	48%
2005	20%	20%	31%	32%	50%	48%
Applicants and Registrants with GPA 80+						
1994	23%	23%	33%	34%	44%	43%
1995	22%	22%	33%	34%	45%	44%
1996	22%	22%	34%	34%	44%	44%
1997	22%	22%	33%	33%	46%	45%
1998	21%	21%	33%	33%	46%	45%
1999	21%	21%	33%	33%	47%	46%
2000	20%	20%	33%	34%	46%	46%
2001	20%	21%	33%	33%	47%	46%
2002	20%	20%	32%	33%	48%	47%
2003	19%	19%	32%	33%	48%	48%
2004	21%	20%	32%	33%	48%	47%
2005	20%	20%	32%	33%	48%	47%

*High, Middle and Low are defined by the 33rd and 67th percentililes of the distribution of postal codes by the equivalent average income of the Census Dissemination Area with which the postal code is associated.